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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,697	09/12/2003	Kevin Andrew Chamness	242662US6YA	7662

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EXAMINER	
WEST, JEFFREY R	
ART UNIT	**PAPER NUMBER**
2857	

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	03/13/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 03/13/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/660,697	CHAMNESS, KEVIN ANDREW	
	Examiner	Art Unit	
	Jeffrey R. West	2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 20 February 2007.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-50 is/are pending in the application.

4a) Of the above claim(s) 43-46,49 and 50 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-42,47 and 48 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 07 November 2005 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 20, 2007, has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 19-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 19 recites, "said updated adaptive centering coefficient implemented in the PCA model to provide, based on the statistical quantity, an improved process center for the substrate processing in order to update the substrate processing during the

course of semiconductor manufacturing for the second set by providing an output assessing the process being performed in the processing system."

The specification describes the updated centering coefficient implementation on page 18, paragraph 0092 to page 19, paragraph 0096:

> ...represents the current value of the j^{th} data parameter for the current run, and Z is a weighting factor ranging from a value of 0 to 1. For example, when $\lambda=1$, the model mean value utilized for centering each data parameter is the previously used value, and, when $\lambda=0$, the model mean value utilized for centering each data parameter is the current measured value.
>
> The model standard deviations (utilized for scaling) for each summary statistic are updated using the following recursive standard deviation filter...
>
> ...The filter constant k can, for example, be selected as a constant less than or equal to N, where N represents the number of substrate runs, or observations, utilized to construct the PCA model.
>
> ...
>
> FIG. 6B shows the same example of using a PCA model to monitor the Q-statistic that was presented in FIG. 6A, except that the centering and scaling coefficients are updated using an adaptation scheme in accordance with the present invention. As seen in this figure, after the first 500 wafers, when the centering and scaling constants are adapted using adaptive centering and scaling coefficients described above (X=0.92; k=500), the Q-statistic chart is substantially more stable across all of the remaining substrates, and the data predominantly resides within the same limit. The inventive adaptation scheme provides similar improvement to other statistical monitoring schemes (e.g., the Hotelling T^2 parameter). Thus, adaptation of the PCA model in accordance with the present invention allows for a more robust PCA model that can be used for long process runs.

As can be seen by this section, the updated adaptive centering coefficient is implemented in the PCA model to provide modification of data parameters for improving a process center, but the updated adaptive centering coefficient does not provide an output assessing the process being performed in the processing system.

Claims 20-24 are rejected under 35 U.S.C. 112, first paragraph, because they incorporate the lack of written description present in parent claim 19.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 7, 8, 11-16, 25, 27, 33, 35, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2003/0055523 to Bunkofske et al. in view of U.S. Patent Application Publication No. 2002/0107858 to Lundahl et al. and further in view of Li et al., "Recursive PCA for adaptive process monitoring".

Bunkofske discloses a method of monitoring a processing system for processing a substrate during the course of semiconductor manufacturing (0002 and 0048), comprising acquiring data from said processing system for a plurality of observations, said data comprising a plurality of data parameters/variables (0049 and 0052); constructing a principal components analysis (PCA) model from said data (0047), including centering and scaling (0056); determining at least one statistical quantity from said data using said PCA model (0043 and 0047); setting a control limit for said at least one statistical quantity (0059); comparing said at least one statistical quantity to said control limit (0059) in order to determine if the substrate processing remains within control during the course of manufacturing

(0086), and providing an output assessing the process being performed in the processing system (0049 and 0053).

Bunkofske discloses detecting a process fault has occurred when said at least one statistical quantity exceeds said control limit (0059).

Bunkofske discloses that constructing said PCA model comprises determining one or more principal components of said data for said plurality of observations using principal components analysis (0012).

Bunkofske discloses that said plurality of data parameters comprises an instantaneous value of at least one of chamber pressure and RF power (0006).

Bunkofske discloses that said statistical quantity comprises at least one of a Q-statistic and a Hotelling T^2 parameter (0043).

Bunkofske further discloses a controller as part of a process performance monitoring system coupled to a process tool, inherently operating in accordance with a program stored on computer readable medium, for carrying out the method as well as coupled to a plurality of sensors attached to the process tool for acquiring the data (0019 and 0049).

As noted above, Bunkofske teaches many of the features of the claimed invention and while Bunkofske does explicitly disclose that the measurement data used for constructing a principle components analysis "is scaled and centered and a correlation matrix is calculated" (0056), the disclosure of Bunkofske does not provide details regarding this process.

Lundahl teaches a method and system for the dynamic analysis of data using principal components analysis (0065) and further teaches the well-known method of performing centering and scaling comprising applying centering coefficients to each of a plurality data parameters by subtracting centering coefficients from each of said data parameters and applying scaling coefficients to each of a plurality of data parameters by dividing each of said data parameters by said scaling coefficients (0059 and 0060).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske to include the scaling and centering method of Lundahl because the combination would have provided the well-known method for carrying out the centering and scaling in a conventional manner as required in the method of Bunkofske (0059 and 0060).

Further, while the invention of Bunkofske and Lundahl does teach many of the features of the claimed invention including applying centering coefficients to each of a plurality of data parameters in a PCA model, wherein the centering coefficients are determined based on the data from the processing system, the combination does not specify that the method acquire additional data from the processing system after constructing the PCA model to form adjusted data and adjusted centering/scaling coefficients.

Li teaches a method and system for applying principal component analysis to the monitoring of industrial microelectronics manufacturing processing system (page 471, "Introduction", column 1, lines 1-4) including acquiring initial data from said

processing system (page 473, "2.2 Recursive correlation matrix calculation", column 1, lines 1-4) for a plurality of observations from a first set of substrate runs having performed a process in the processing system (page 483, "Application to a rapid thermal annealing process", column 1, line 1 to column 2, line 12), constructing principal component analysis model from said data parameters of the first set (page 473, "2.2 Recursive correlation matrix calculation", column 1, lines 1-4), said PCA model being centered/scaled (page 472, "Introduction", column 1, lines 8-14), acquiring additional data from said processing system after said constructing step (page 473, "2.2 Recursive correlation matrix calculation", column 2, lines 1-16) from a second set of substrate runs performing said processing the processing system (page 483, "Application to a rapid thermal annealing process", column 1, line 1 to column 2, line 12), adjusting the PCA model and centering/scaling at the time of each observation of the additional data from the second set (page 471, "Introduction", column 2, lines 25-28 and page 474, "2.2 Recursive correlation matrix calculation", column 1, lines 11-13) utilizing both said initial data and current data obtained from the additional observation (page 472, "Introduction", column 1, lines 8-14), and determining at least one statistical quantity using a combination of said PCA model and the additional data for determining substrate processing quality (page 472, "Introduction", column 1, lines 4-6 and page 480, "7. Recursive process monitoring", column 1, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske and Lundahl to specify that the method acquire additional

data from the processing system after constructing the PCA model to form adjusted data and adjusted centering/scaling coefficients, as taught by Li, because the invention of Bunkofske and Lundahl teaches processing the acquired data from the processing system to form centering and scaling coefficients and Li suggests that the combination would have improved the overall analysis of Bunkofske and Lundahl by providing real time updating of the data from the system thereby keeping the process data and scaling/centering coefficients accurate to detect an abnormal process faster and reduce the possibility of false alarms thereby increasing reliability of the monitoring system (page 471, "Introduction", column 1, line 16 to column 2, line 6 and page 472, "Introduction", column 1, lines 8-10).

6. Claims 2-6, 19-23, 26, and 34, as may best be understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al. and Li et al. and further in view of U.S. Patent No. 6,622,059 to Toprac et al.

As noted above, Bunkofske in combination with Lundahl and Li teaches many of the features of the claimed invention, and while the invention of Bunkofske, Lundahl, and Li does teach generating centering and scaling coefficients which are determined based on updated process data, and therefore also updated, the combination does not specifically provide the method for updating the centering coefficient.

Toprac teaches an automated process monitoring and analysis system for semiconductor processing comprising acquiring data from said processing system

for a plurality of observations, said data comprising a plurality of data parameters (column 4, lines 9-23), constructing a principal components analysis (PCA) model from said data (column 10, lines 46-51), acquiring additional data from said processing system, said additional data comprising an additional observation (i.e. current measurement) of said plurality of data parameters, obtaining a mean of the data parameters, and adjusting the mean of the data parameters to form an updated mean (column 18, lines 27-46).

Toprac teaches that adjusting the mean of the data parameters comprises updating the mean of the data parameters for each data parameter by combining an old value of the mean for each data parameter and a current value of each data parameter for said additional observation, wherein said old value comprises a mean value of the data parameter during said plurality of observations (column 18, lines 27-46).

Toprac further teaches that combining said old value of said adaptive mean and said current value of said data parameter for said additional observation comprises applying an exponentially weighted moving average filter (column 18, lines 27-46) as well as setting a weighting factor to any value ranging from 0.0 to 1.0 as appropriate based on an amount of confidence (column 18, lines 47-53).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, and Li to specify the method for updating the centering coefficient, as taught by Toprac, because the invention of Bunkofske, Lundahl, and Li does teach generating the centering coefficient as a mean of

consistently updated process data wherein the process data is obtained by a moving calculation (i.e. updated with every new sample) (Li, page 471, "Introduction", column 2, lines 25-28 and page 474, "2.2 Recursive correlation matrix calculation", column 1, lines 11-13) and Toprac suggests that the combination would have provided a corresponding method for updating the centering coefficient/mean that would have improved the centering performed by Bunkofske, Lundahl, and Li by applying a centering coefficient that is consistently updated and weighted based on confidences corresponding to the data obtained (column 18, lines 47-53).

7. Claims 9, 10, 28, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al. and Li et al and further in view of U.S. Patent No. 5,796,606 to Spring.

As noted above, Bunkofske in combination with Lundahl and Li teaches many of the features of the claimed invention, and while the invention of Bunkofske, Lundahl, and Li does teach generating centering and scaling coefficients which are determined based on updated process data, and therefore also updated, the combination does not specifically provide the method for updating the scaling coefficient.

Spring teaches a process information and maintenance system for distributed control systems including means for obtaining data and from the data calculating/filtering a standard deviation using an exact recursive standard deviation

employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and a constant (column 6, line 41 to column 7, line 8).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, and Li to specify the method for updating the scaling coefficient, as taught by Spring, because the invention of Bunkofske, Lundahl, and Li does teach generating the scaling coefficient as a standard deviation of consistently updated process data wherein the process data is obtained by a recursive calculation (i.e. updated with every new sample) (Li, page 471, "Introduction", column 2, lines 25-28 and page 474, "2.2 Recursive correlation matrix calculation", column 1, lines 11-13) and Spring suggests that the combination would have provided a corresponding method for updating the scaling coefficient/standard deviation that would have improved the scaling performed by Bunkofske, Lundahl, and Li by applying a scaling coefficient that is consistently updated and weighted based on a window that allows discounting of the oldest information using exponential-weighting-into-the-past (column 6, line 41 to column 7, line 8).

Further since the invention of Spring performs recursive standard deviation employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and the invention of Bunkofske, Lundahl, and Li defines the standard deviation as a scaling coefficient and the mean value as a centering coefficient, the combination performs recursive standard deviation employing an old value of the scaling coefficient, a current value of additional data, an old value of the centering coefficient.

8. Claim 24, as may best be understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al., Li et al., and Toprac et al. and further in view of U.S. Patent No. 5,796,606 to Spring.

As noted above, Bunkofske in combination with Lundahl, Li, and Toprac teaches many of the features of the claimed invention, and while the invention of Bunkofske, Lundahl, Li, and Toprac does teach generating centering and scaling coefficients which are determined based on updated process data, and therefore also updated, the combination does not specifically provide the method for updating the scaling coefficient.

Spring teaches a process information and maintenance system for distributed control systems including means for obtaining data and from the data calculating/filtering a standard deviation using an exact recursive standard deviation employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and a constant (column 6, line 41 to column 7, line 8).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, Li, and Toprac to specify the method for updating the scaling coefficient, as taught by Spring, because the invention of Bunkofske, Lundahl, Li, and Toprac does teach generating the scaling coefficient as a standard deviation of consistently updated process data wherein the process data is obtained by a recursive calculation (i.e. updated with every new sample) (Li, page 471, "Introduction", column 2, lines 25-28 and page 474, "2.2 Recursive correlation matrix

calculation", column 1, lines 11-13) and Spring suggests that the combination would have provided a corresponding method for updating the scaling coefficient/standard deviation that would have improved the scaling performed by Bunkofske, Lundahl, Li, and Toprac by applying a scaling coefficient that is consistently updated and weighted based on a window that allows discounting of the oldest information using exponential-weighting-into-the-past (column 6, line 41 to column 7, line 8).

Further since the invention of Spring performs recursive standard deviation employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and the invention of Bunkofske, Lundahl, Li, and Toprac defines the standard deviation as a scaling coefficient and the mean value as a centering coefficient, the combination performs recursive standard deviation employing an old value of the scaling coefficient, a current value of additional data, an old value of the centering coefficient.

9. Claims 17, 18, 29-32, 37-42, and 48, are rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al. and Li et al and further in view of U.S. Patent Application Publication No. 2003/0144746 to Hsiung et al.

As noted above, Bunkofske in combination with Lundahl and Li teaches many of the features of the claimed invention and while the invention of Bunkofske, Lundahl, and Li does teach acquiring many types of data, including adaptive scaling

coefficients, the combination does not specifically include obtaining the many types of data via at least one of an intranet and an internet from a second process.

Hsiung teaches control for an industrial process using one or more multidimensional variables comprising a first industrial process connected to a second industrial process and/or server via an internet for accessing data (0036, 0040, and 0045) wherein the data is used in performing principal component analysis (0066 and 0106).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, and Li to specifically include obtaining the many types of data via at least one of an intranet and an internet from a second process, as taught by Hsiung, because, as suggested by Hsiung, the combination would have improved the overall analysis of the first process by validating the many types of data by comparison with the same data from a similar process (0036).

Response to Amendment

10. The declaration filed on February 20, 2007, under 37 CFR 1.131 is sufficient to overcome the Jahns et al. reference.

Response to Arguments

11. Applicant's arguments with respect to claims 1-42, 47, and 48 have been considered but are moot in view of the new grounds of rejection:

The Examiner does note, however, that in addition to filing the 37 CFR 1.131 declaration to overcome the Jahns et al. reference, Applicant argues the outstanding rejection as missing the feature of adjusting centering coefficients at the time of each observation of additional data. The Examiner asserts that the newly applied Li reference is explicit in its teaching of such a feature.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

U.S. Patent No. 5,949,678 to Wold et al. teaches a method for monitoring multivariate process comprising performing PCA by applying centering and scaling (column 11, lines 60-65) wherein the centering is performed using a EWMA filter and subtracting centering values to update the EWMA (column 12, lines 18-30) and scaling is performed by dividing the data set by a standard deviation wherein the standard deviation (i.e. scaling coefficient) is updated/adapted based on weighted local data (column 12, lines 31-42)

U.S. Patent No. 6,896,763 to Balasubramhanya et al. teaches a method and apparatus for monitoring a process by employing principal component analysis.

U.S. Patent No. 6,330,526 to Yasuda teaches a characteristic variation evaluation method of a semiconductor device.

U.S. Patent No. 6,675,137 to Toprac et al. teaches a method of data compression using principal components analysis.

U.S. Patent Application Publication No. 2002/0072882 to Kruger et al. teaches multivariate statistical process monitors.

Cherry et al., "Semiconductor Process Monitoring and Fault Detection Using Recursive Multi-Way PCA" teaches a method for quickly and accurately detecting faulty sensors or measurements in a semiconductor processing environment.

Shirazi et al., "A Modular Realization of Adaptive PCA" teaches an adaptive PCA algorithm which alleviates suboptimality of the PCA method for non-stationary signals.

Chatterjee et al., "Algorithms for Accelerated Convergence of Adaptive PCA" teaches an adaptive algorithm for PCA that is shown to converge faster than traditional PCA.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (571)272-2226. The examiner can normally be reached on Monday through Friday, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (571)272-2216. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jeffrey R. West
Examiner – AU 2857

March 3, 2007